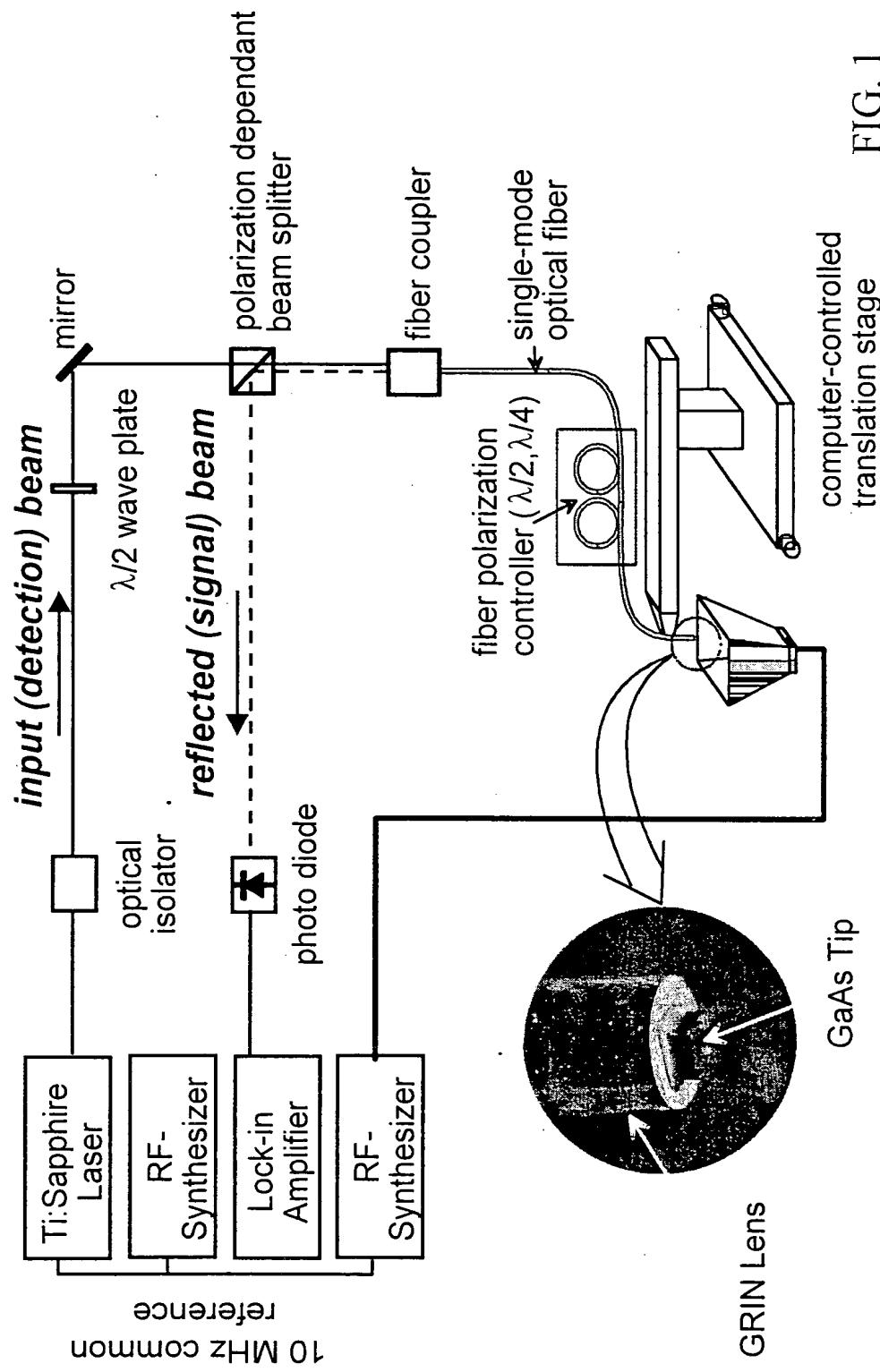




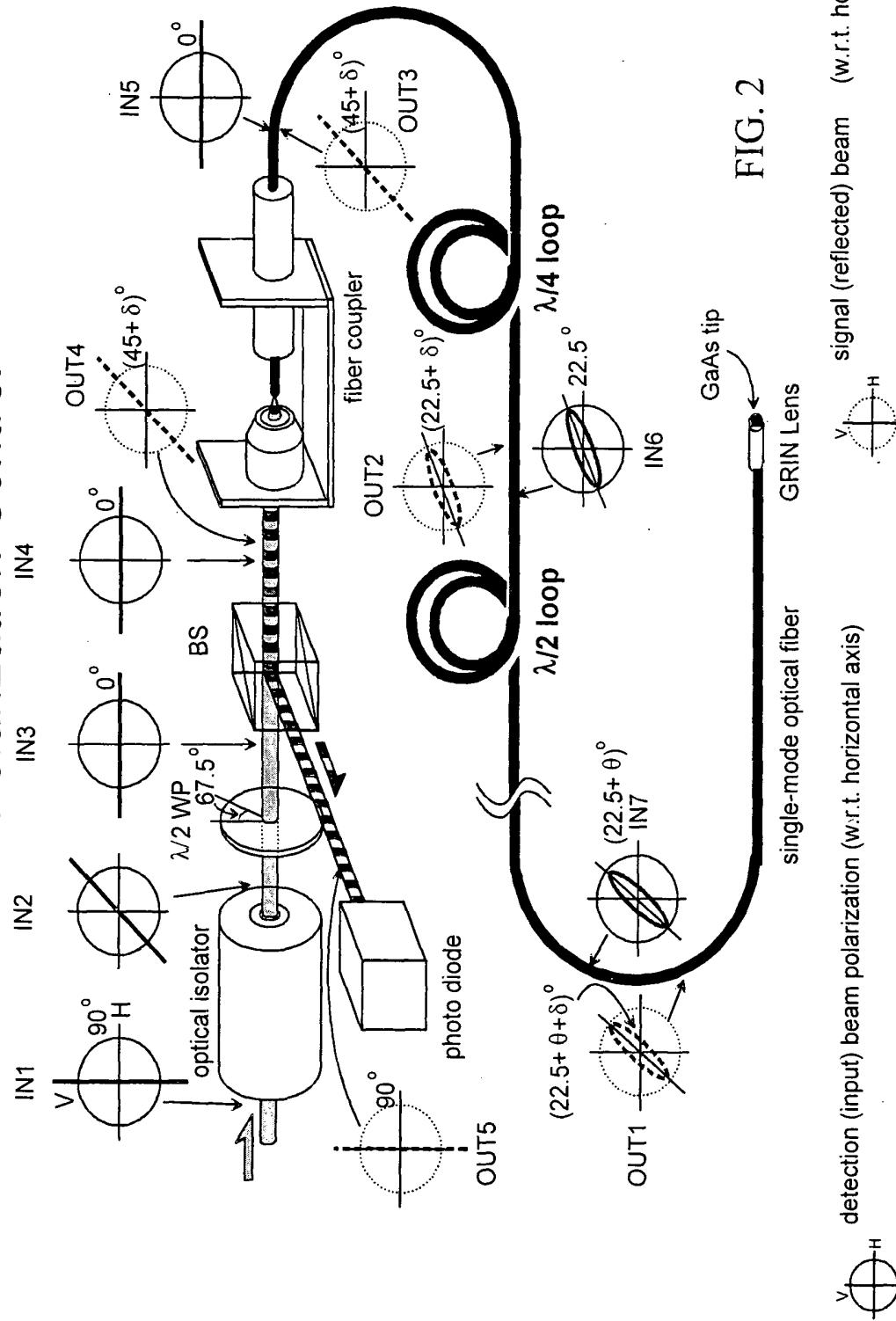
Fiber-Based Electro-Optic Field-Mapping System





Fiber-Based Electro-Optic Field-Mapping System

Polarization Control





Fiber-Based Electro-Optic Sampling System GRIN Lens

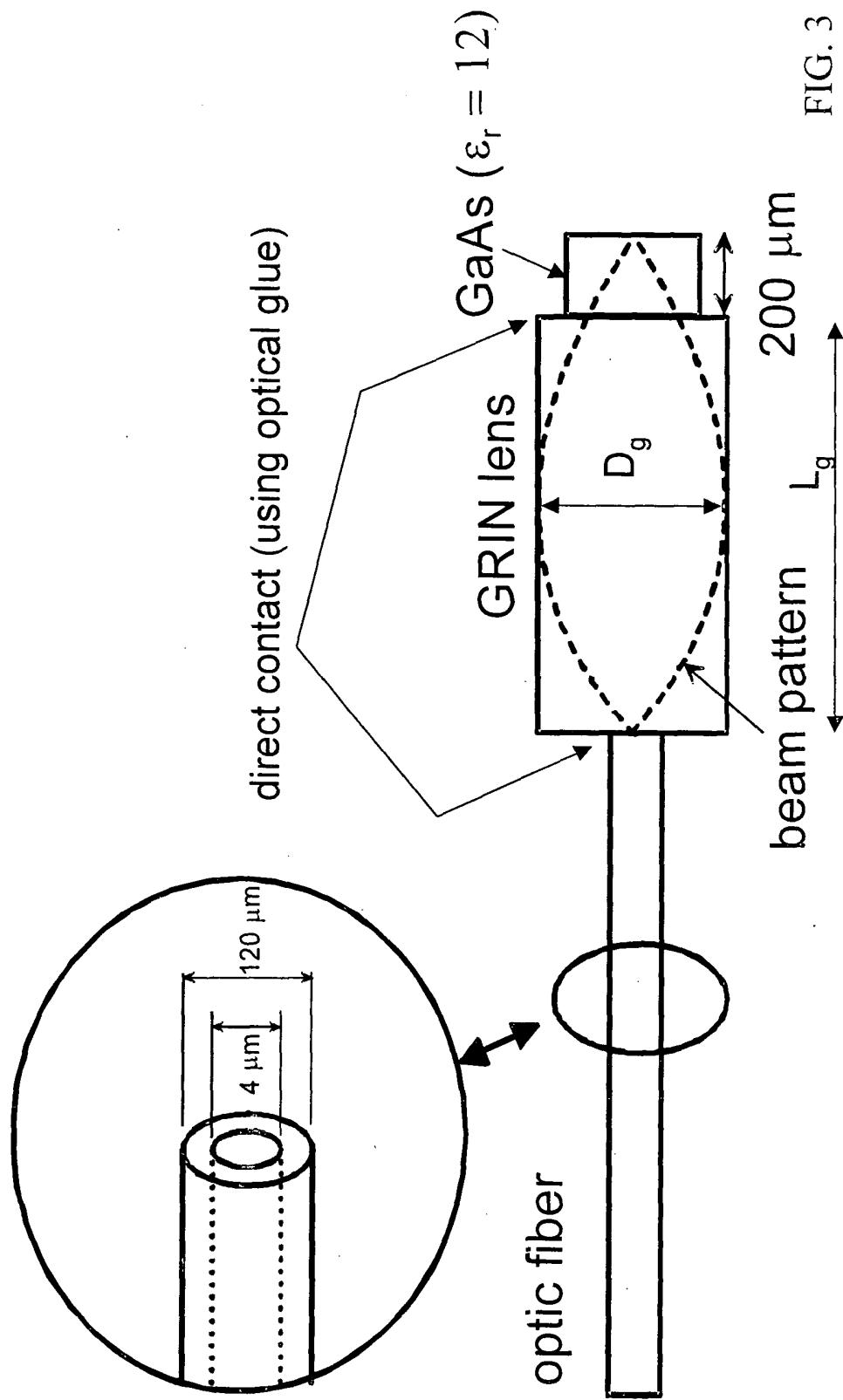


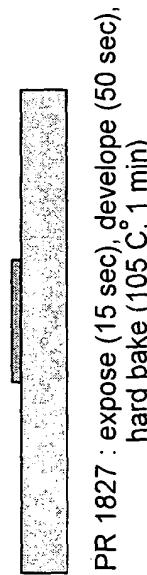
FIG. 3



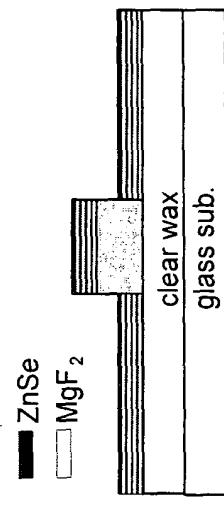
Fiber-Based Electro-Optic Sampling System Probe Tip Fabrication Procedure



expose without mask (15 sec), develope (90 sec)



PR 1827 : expose (15 sec), develope (50 sec),
hard bake (105 C, 1 min)



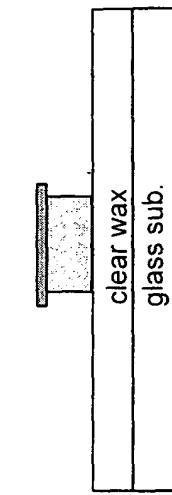
■ ZnSe
□ MgF₂

■ ZnSe
□ MgF₂

clear wax
glass sub.

Distributed Bragg Reflector (DBR) deposition
 $MgF_2 = 1,403 \text{ \AA}$, $ZnSe = 833 \text{ \AA} \times 4$ sets

mount sample on glass substrate
using clear wax (on the 150 C hot plate)



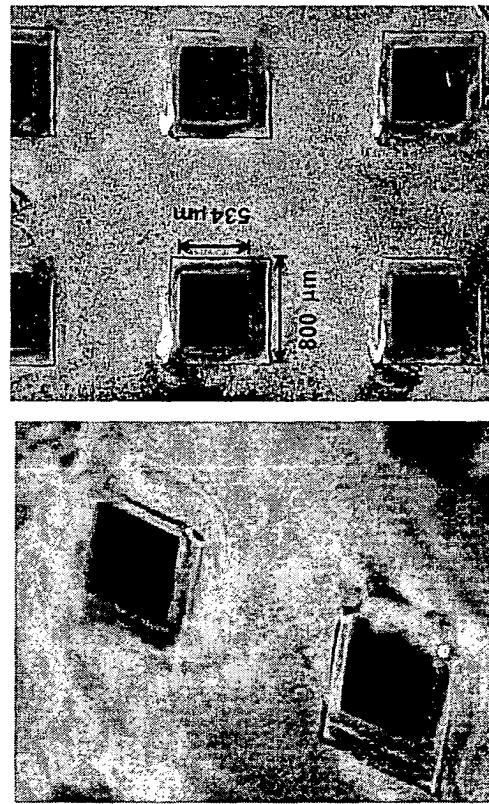
Final probe tip
(released in the hot acetone)

FIG. 4

wet etching : $H_2SO_4 : H_2O_2 : H_2O = 1 : 8 : 1$
 + few drops of NH_4OH
 agitate 30 sec every 30 sec
 change etchant every 10 min.



Fiber-Based Electro-Optic Sampling System Probe Tip Fabrication - (100) GaAs



etching depth \sim 160 μm (7.95 $\mu\text{m}/\text{min} \times 20 \text{ min}$)
 (lateral : 130~150 μm , 6.5~7.5 $\mu\text{m}/\text{min}$)

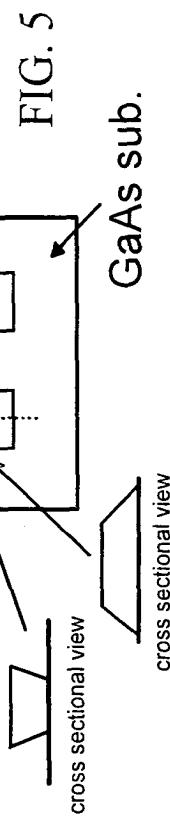
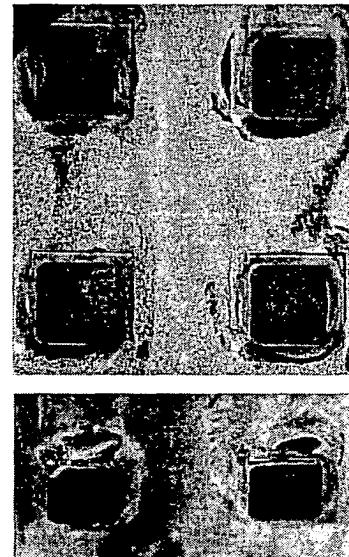
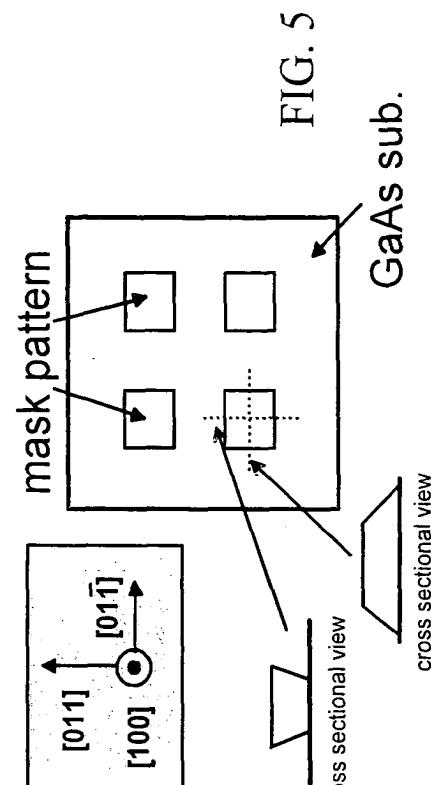
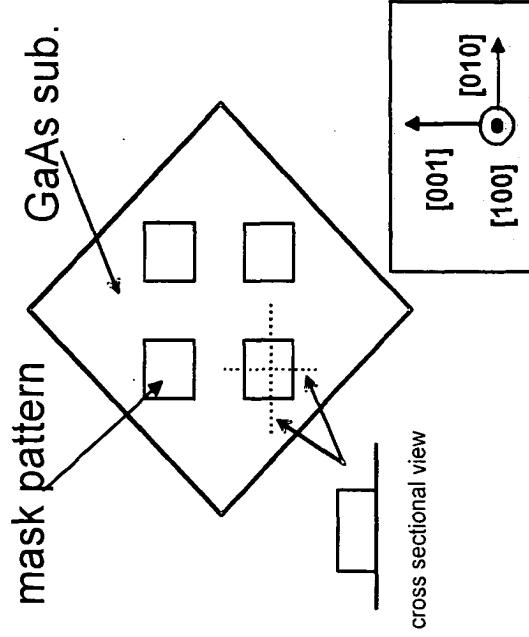


FIG. 5



*Fiber-Based Electro-Optic Sampling System
Probe Tip Fabrication - (110) GaAs*

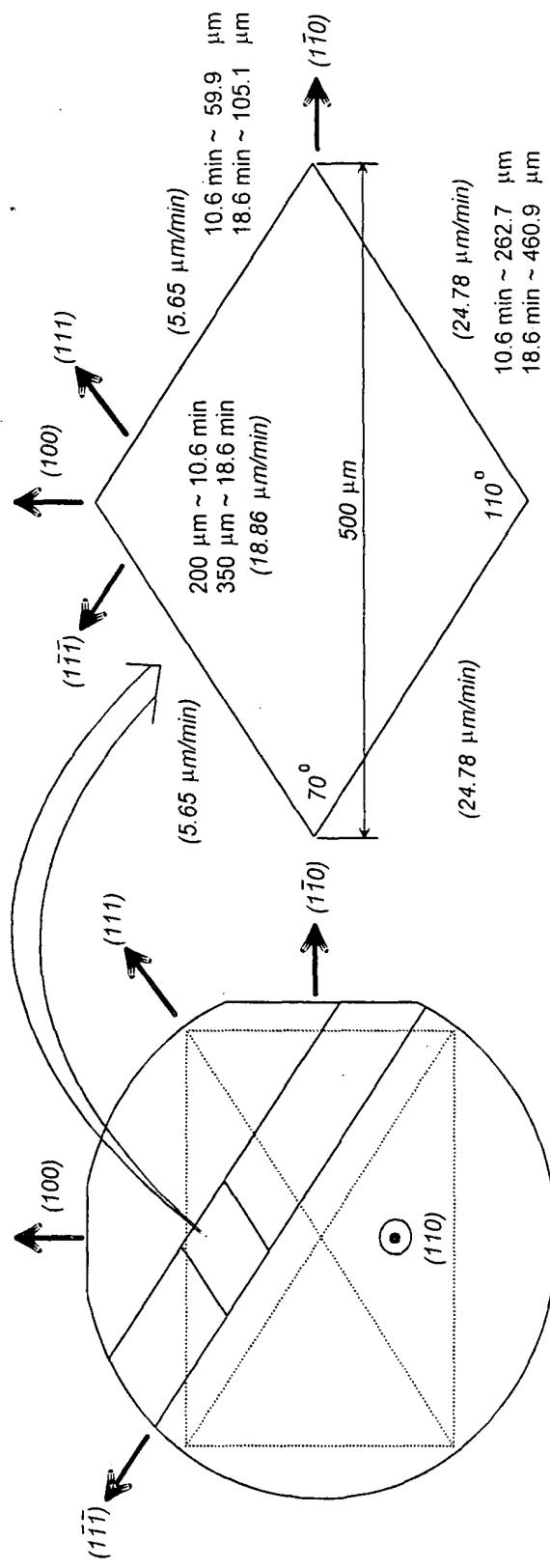
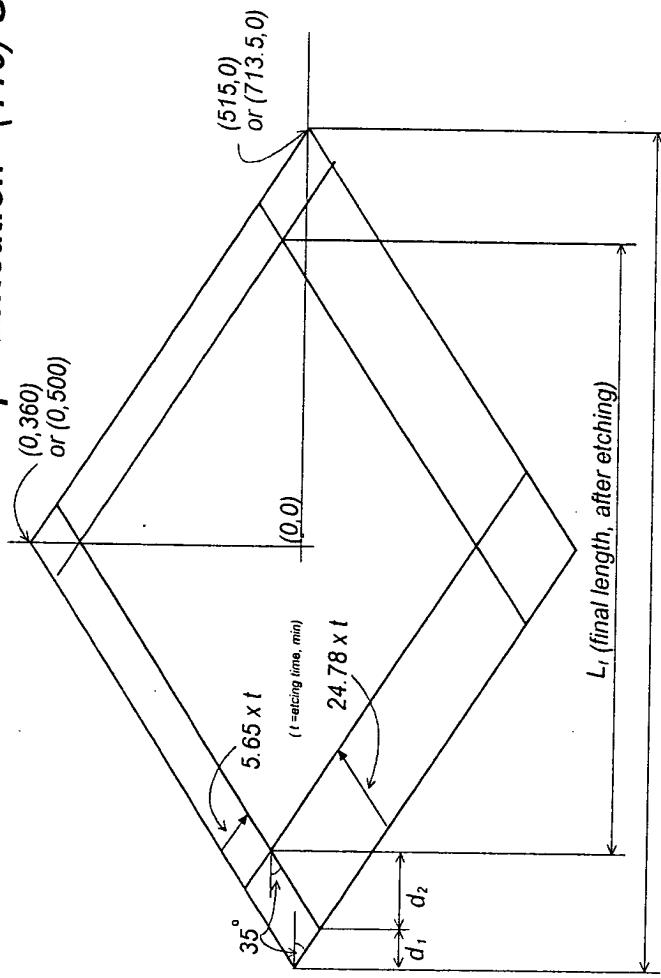


FIG. 6



Fiber-Based Electro-Optic Sampling System Probe Tip Fabrication - (110) GaAs



goal: $L_f = 500 \mu m$

$$\begin{aligned}
 L_1 &= L_1 - (d_1 + d_2) \times 2 \\
 L_1 &= L_1 - \left[\frac{5.65 \times t \times \cos(35)}{500 + \frac{5.65 \times \cos(35)}{24.78 \times t \times \sin(55)}} + \frac{24.78 \times t \times \sin(55)}{500 + \frac{24.78 \times \sin(55)}{2 \times t}} \right] \times 2
 \end{aligned}$$

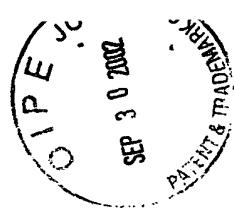
where

where,

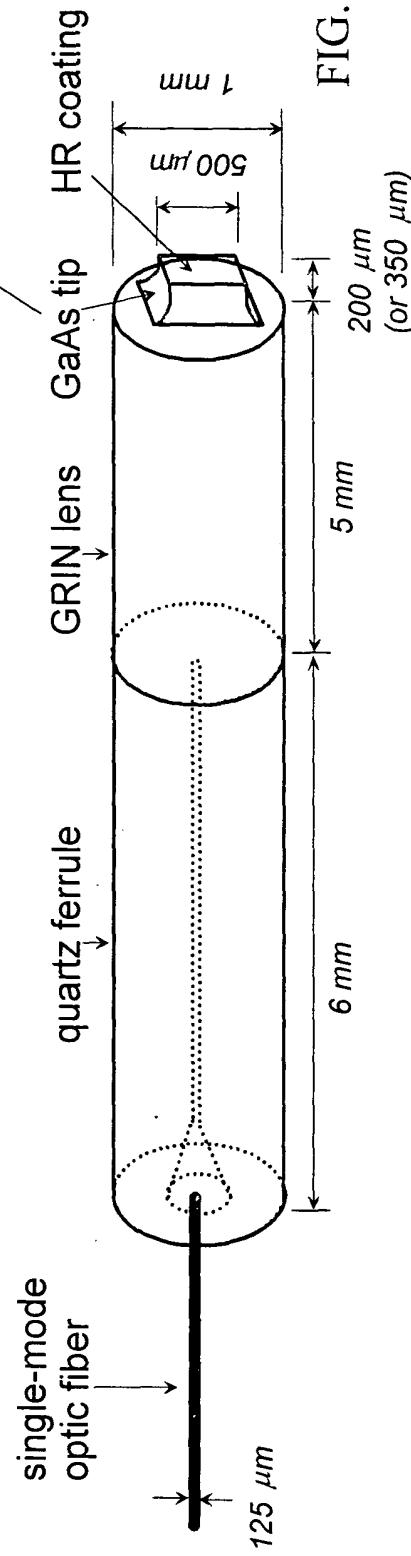
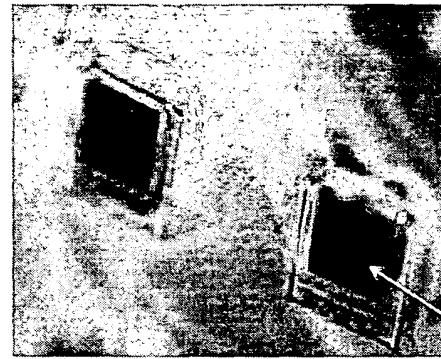
$$\begin{cases} t = 200 / 18.86 \text{ (μm/min)} = 10.6 \text{ min for 200 μm wafer} \\ t = 350 / 18.86 \text{ (μm/min)} = 18.6 \text{ min for 350 μm wafer} \\ t = \text{etching time, min} \end{cases}$$

FIG 7

$$L_i = 1029 \mu\text{m} \text{ for } 200 \mu\text{m} \text{ wafer}, \\ = 1427 \mu\text{m} \text{ for } 350 \mu\text{m} \text{ wafer}$$



Fiber-Based Electro-Optic Sampling System Probe Head Assembly



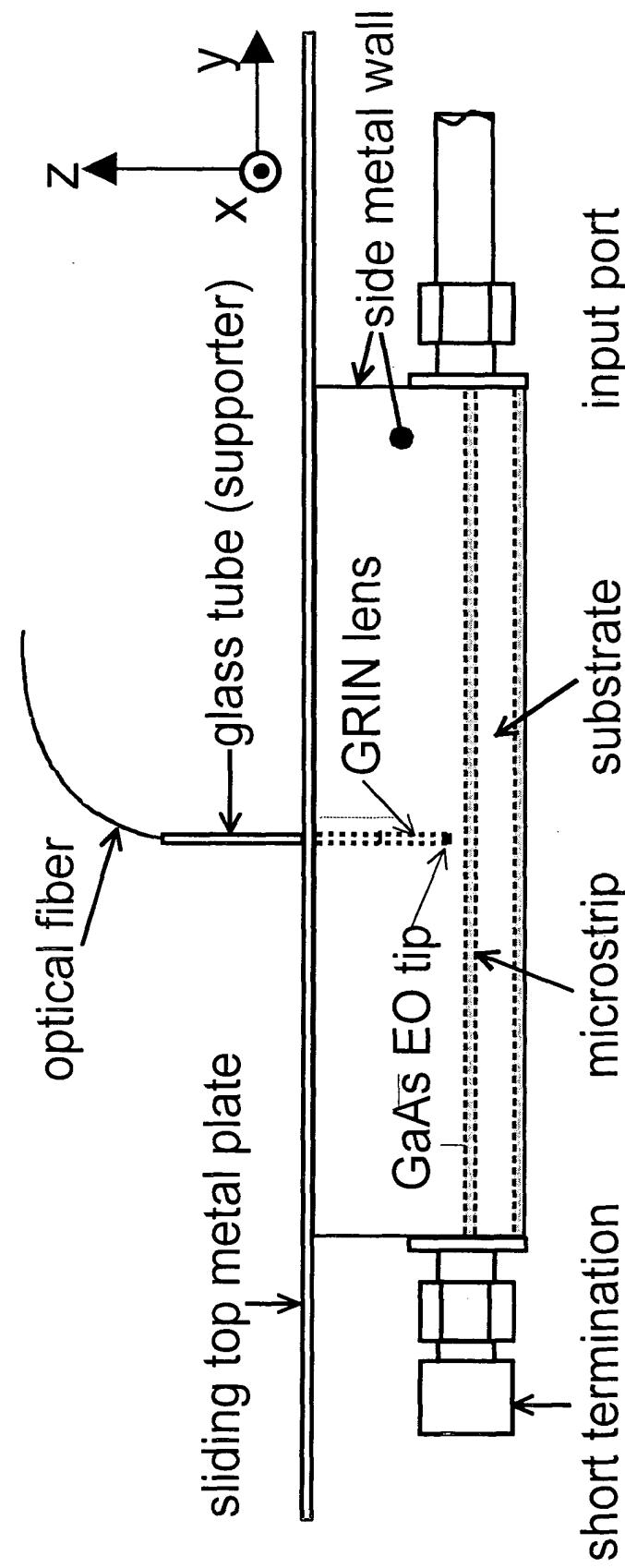


FIG. 9

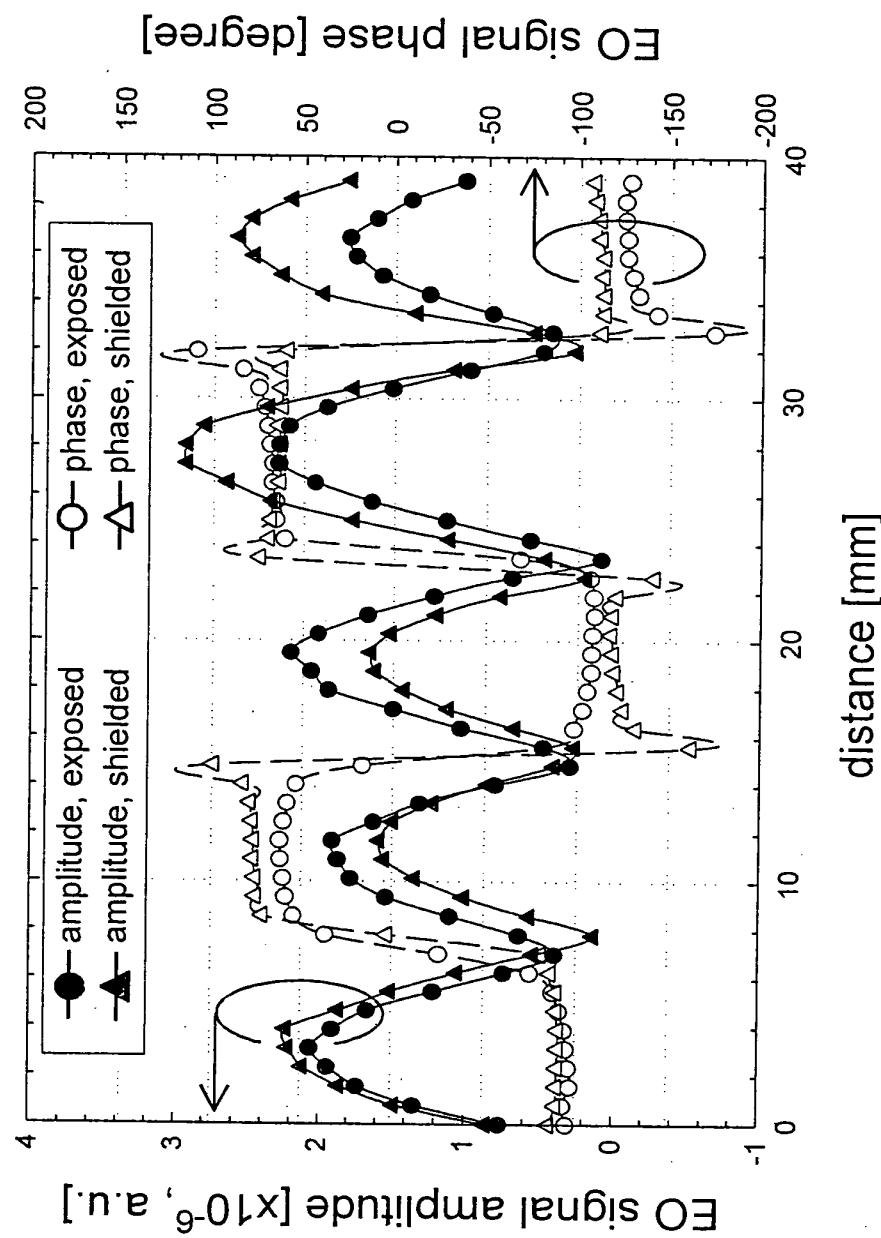


FIG. 10

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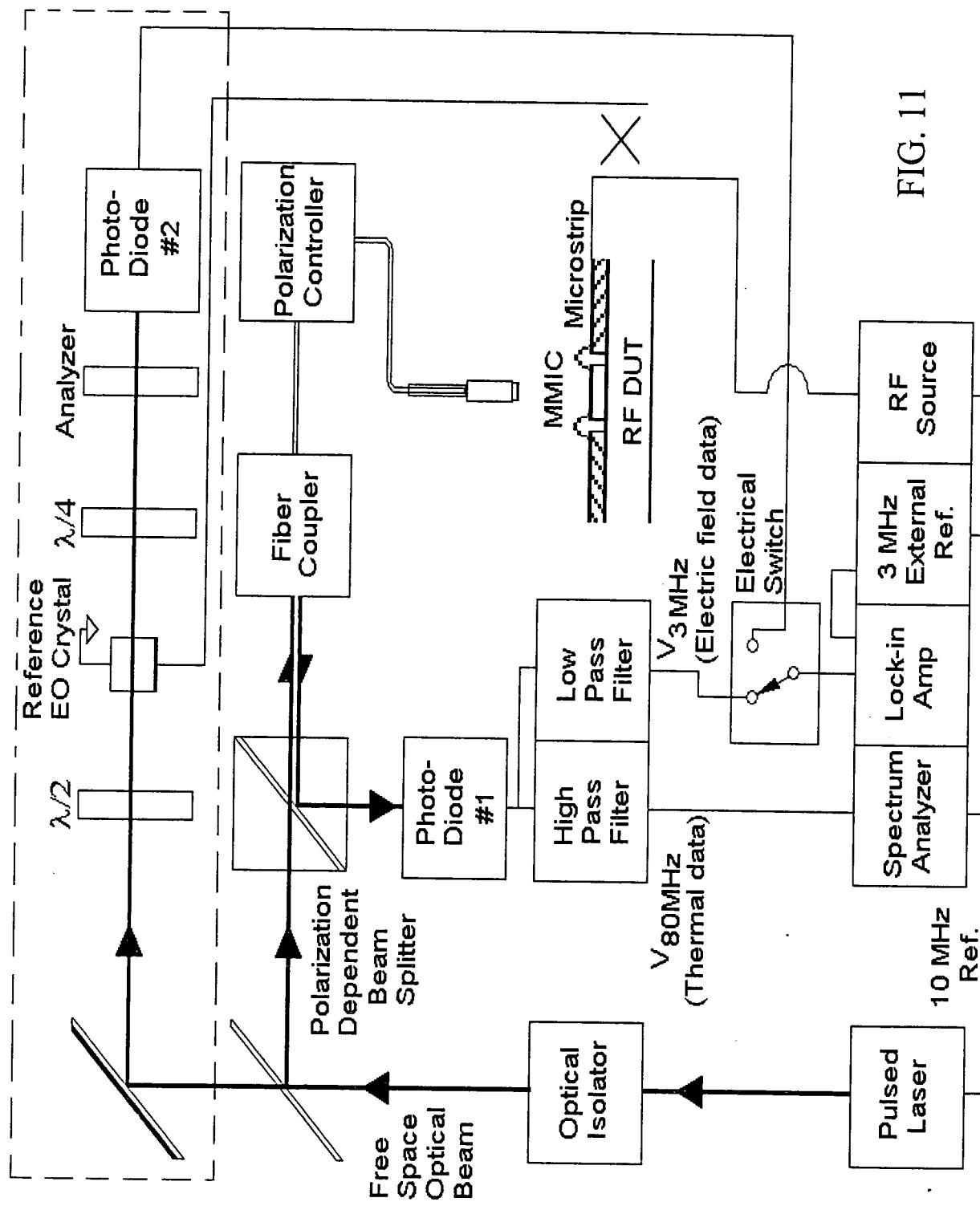


FIG. 11

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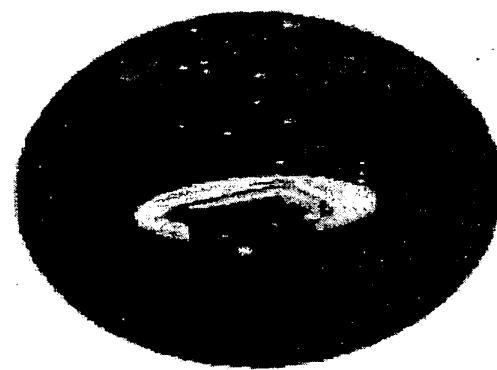


FIG. 12

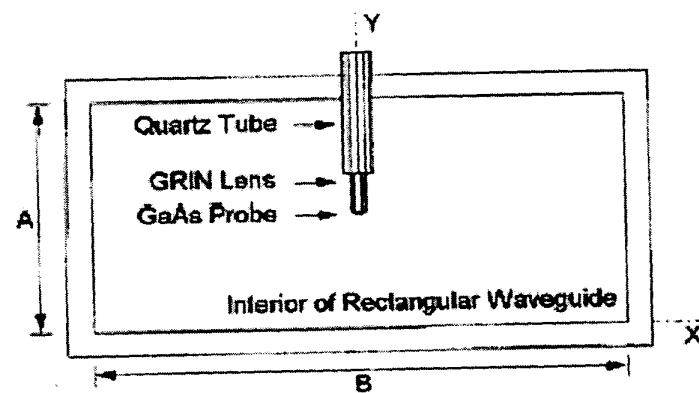


FIG. 13

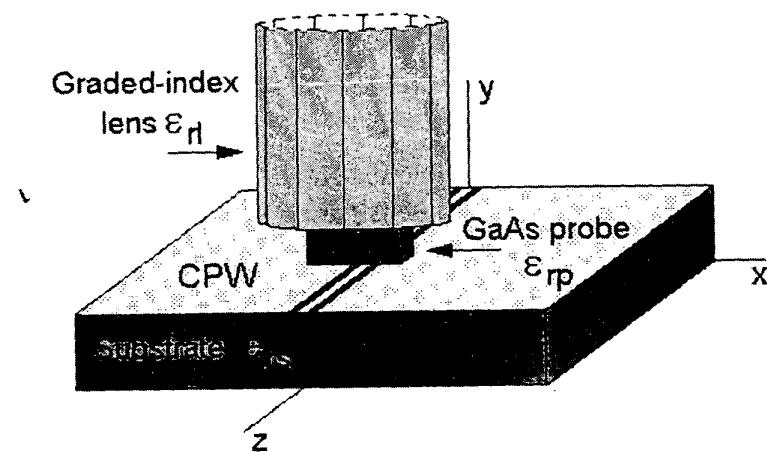
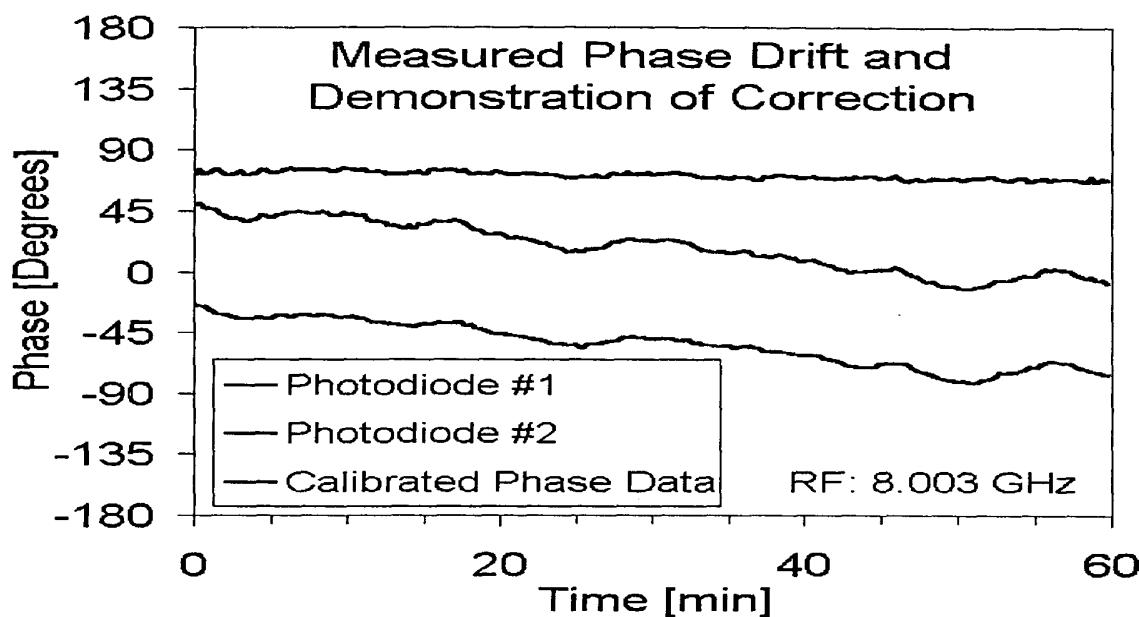


FIG. 14



CHARACTERIZATION – ELECTRIC FIELD PHASE



Over one hour, measured temporal phase stability is $\pm 3^\circ$

FIG. 15

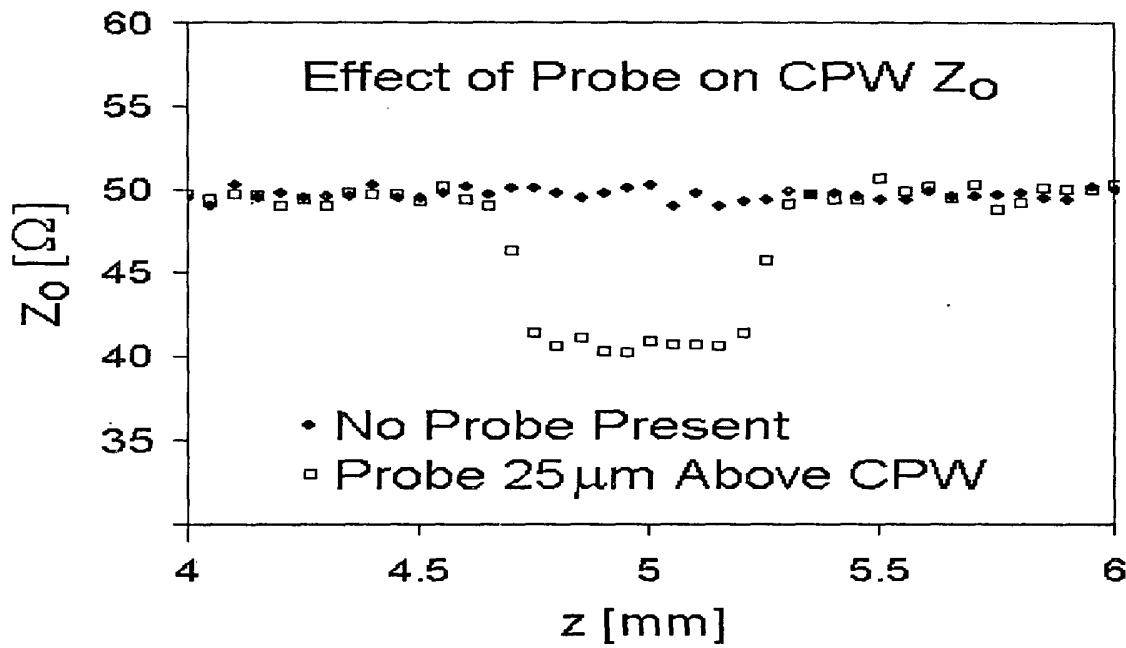
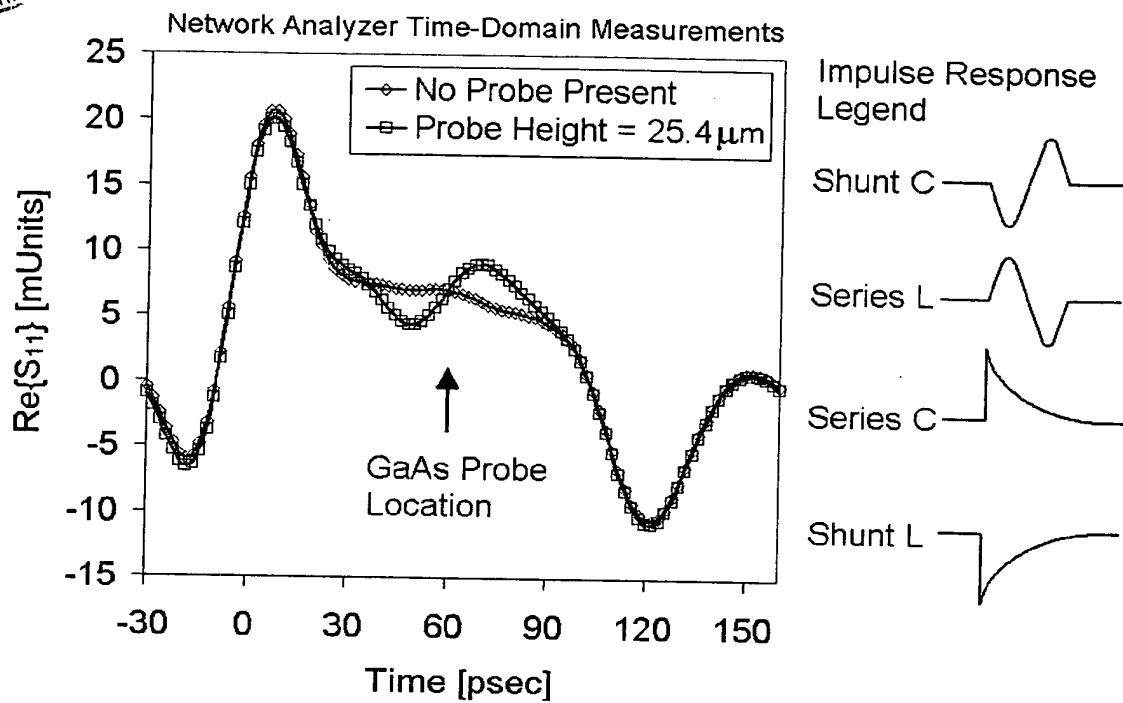


FIG. 16



- Frequency domain measurements (2 - 40 GHz): $|S_{11}| < -30 \text{ dB}$ with and without probe.

FIG. 17

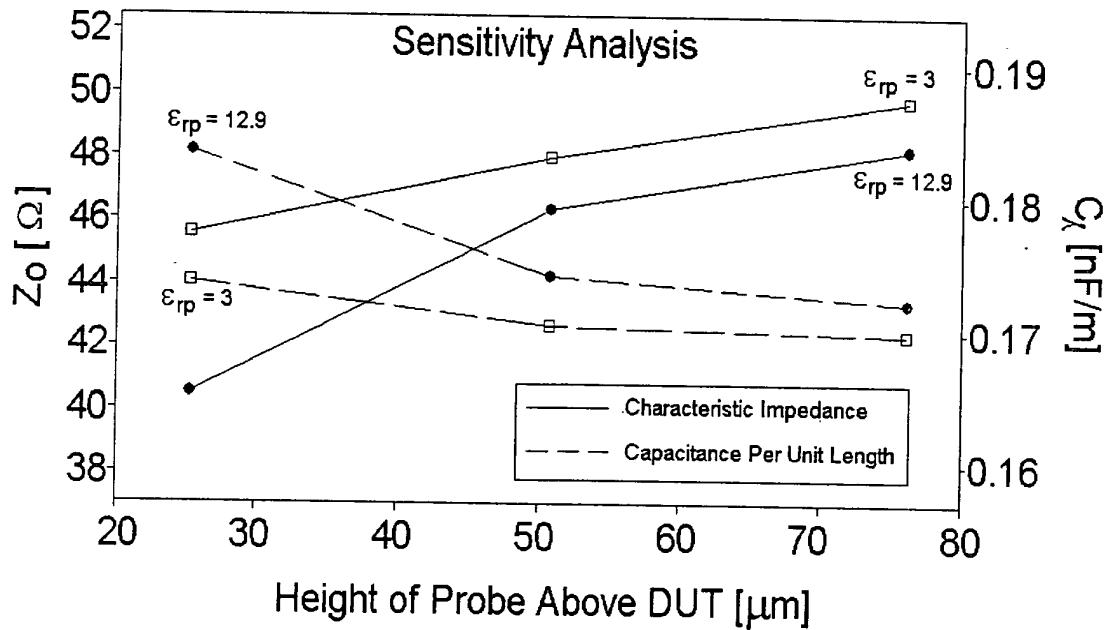


FIG. 18

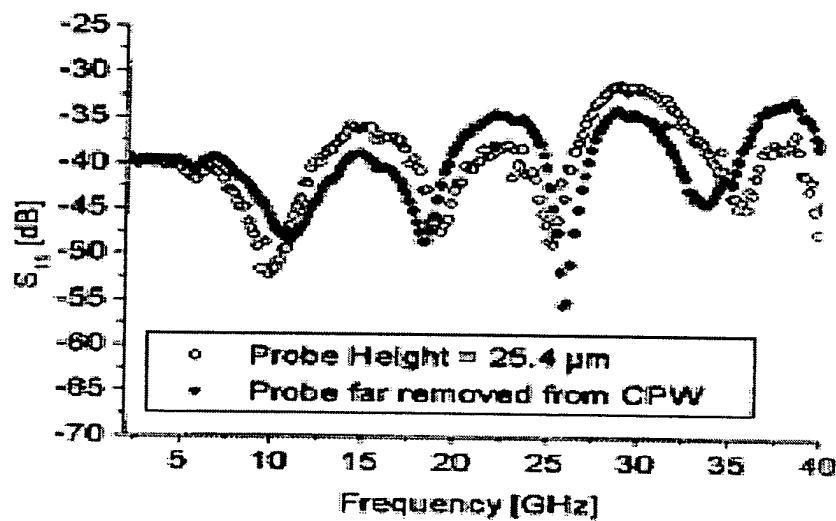


FIG. 19

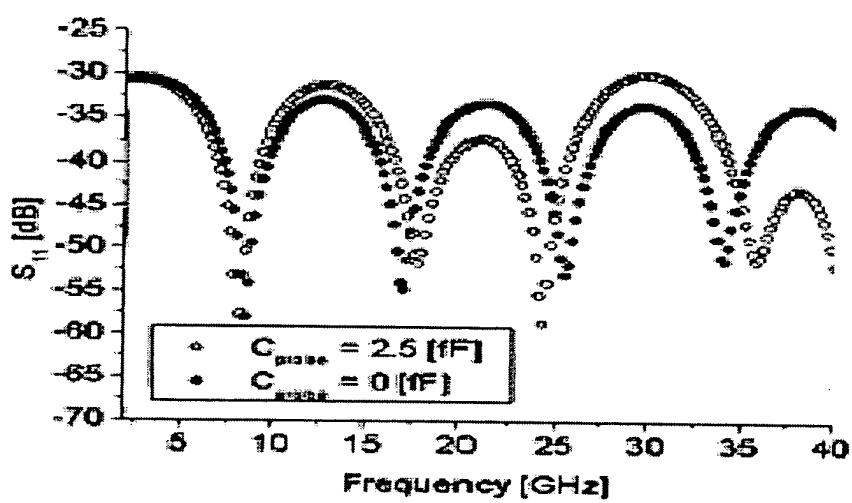


FIG. 20

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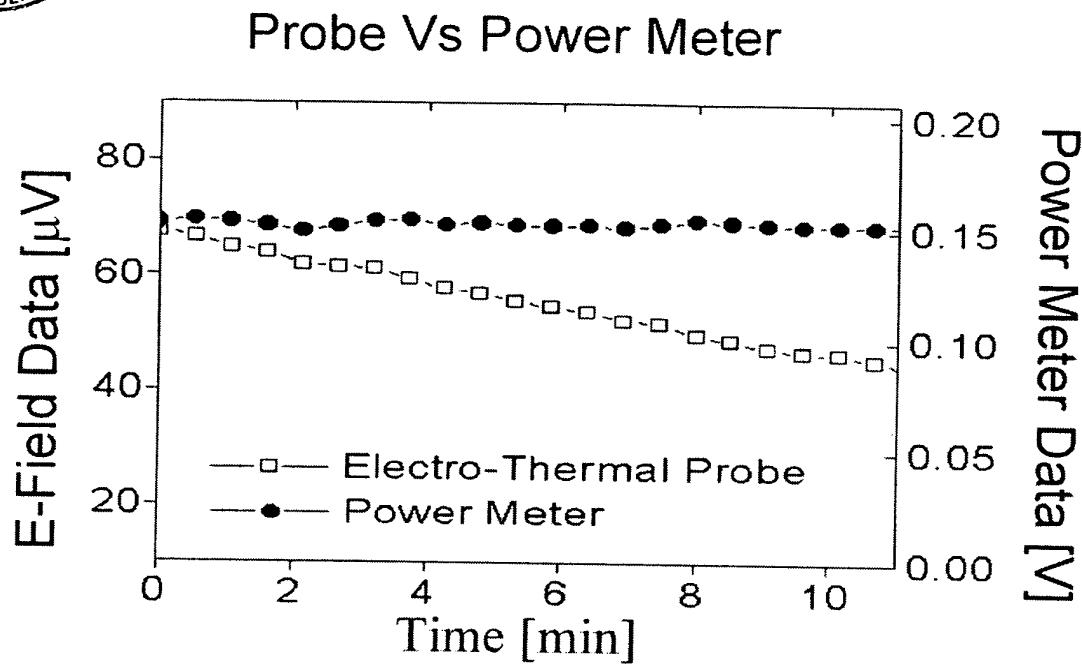


FIG. 21

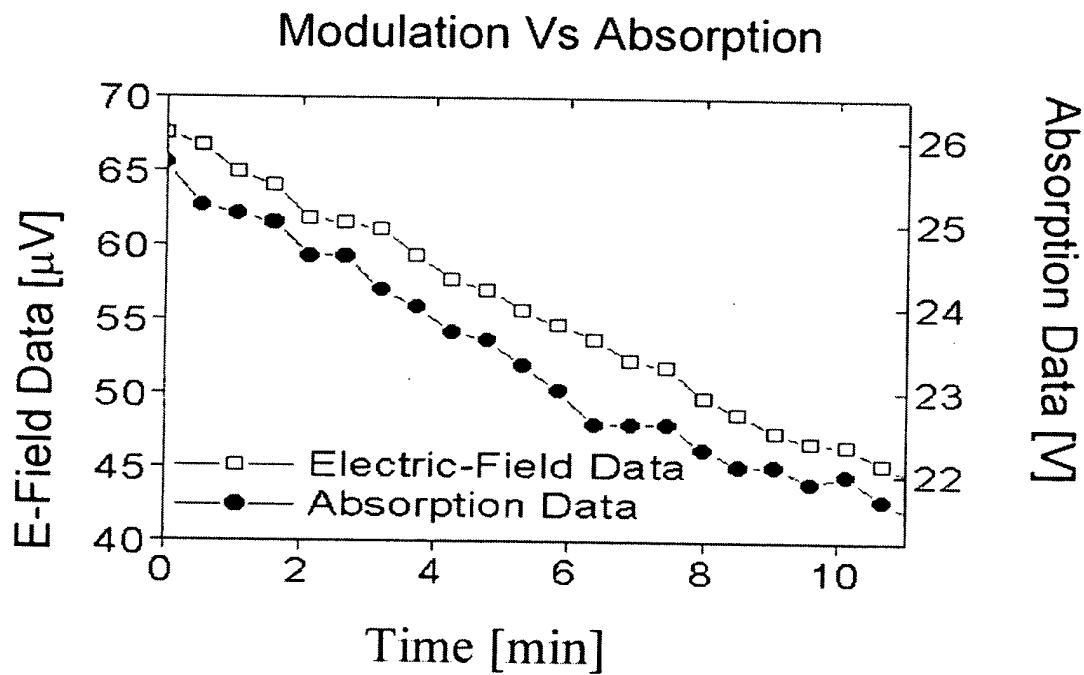


FIG. 22

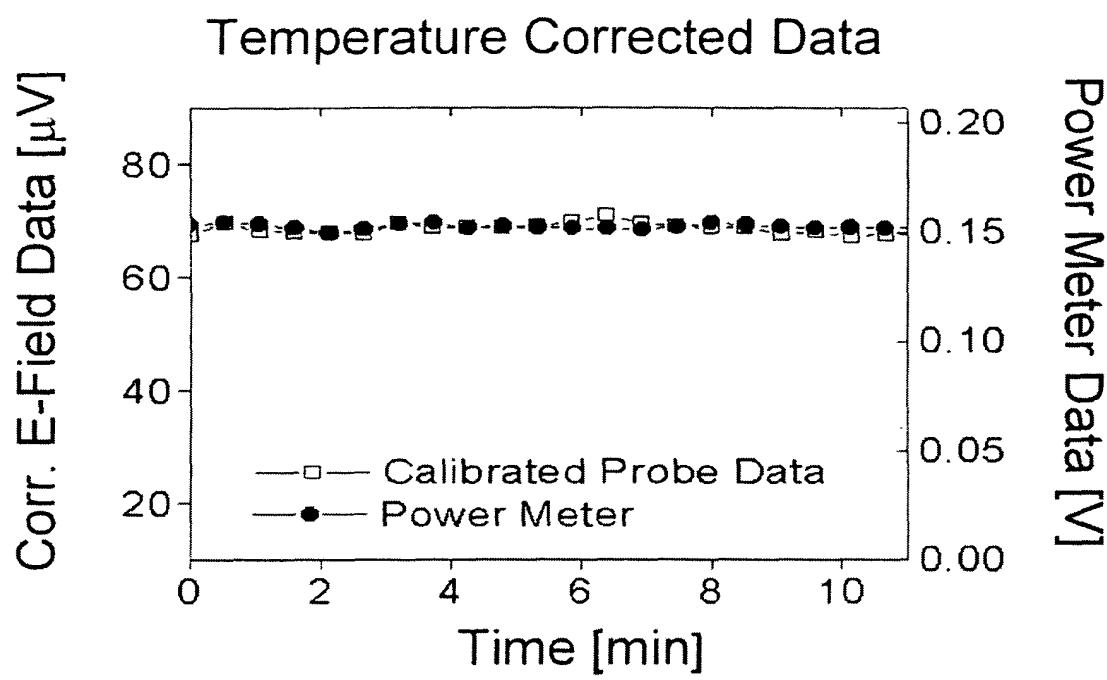


FIG. 23

Simultaneous Measurements

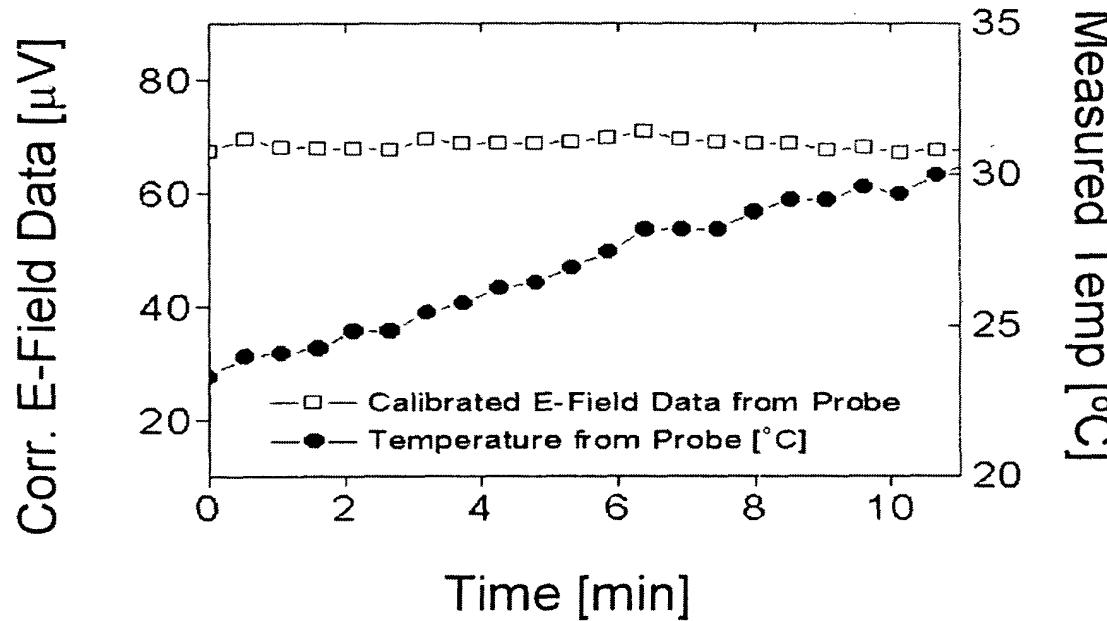


FIG. 24